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AUTHOR'S EDITION.

FROM THE ANNUAL REPORT OF THE DEPARTMENT OF
AGRICULTURE FOR THE YEAR 1886.

REPORT

OF

THE BOTANIST.

DR. GEO. VASEY,

FOR

THE YEAR 1886.

WITH ILLUSTRATIONS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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REPORT OF THE BOTANIST.

SIR: There is in agriculture a conservative tendency to follow in the beaten path of precedent. Hence it is that so small a number of plants are known in cultivation. Very few of the great mass of laborers can afford the time for and the risk attending experiments on a large scale, yet there are very few who cannot devote a little care to the trial of new plants, especially in localities where the ordinary kinds do not prove wholly satisfactory. For instance, the common red and white clovers came to us from Europe, and are almost the only kinds known in cultivation, whereas we have many native species which seem to have the qualities of hardiness, vigor, and size, which would probably render them valuable for the purpose of cultivation.

In those parts of the country where these clovers occur it would not be difficult for farmers or others to make an extended trial of one or more of such kinds, and report the result to this Department or to some agricultural paper for the benefit of others. As a help to such trials, we present herewith a paper on some promising native species of clovers, with such figures and descriptions as will serve to identify them.

As much loss and injury to crops result from the presence of pernicious weeds, as a guide to their recognition and destruction, we present a paper on some of the more important and common weeds of cultivated grounds, with instructions as to the means of eradicating them; this practical part of the information being from the pen of Mr. A. A. Crozier, the Assistant Botanist.

A history of the Division of Botany and an account of its work is also presented, for the information of the public and of all such as are interested in knowing what are its purposes and aims.

HISTORY OF THE DIVISION.

Soon after the completion, in 1868, of the building for the Department of Agriculture it was found necessary to have an experienced Botanist to complete the working force of the Department. It was recognized, also, that one of the first requisites for the use of the Botanist was a herbarium, in which should be represented, as far as possible, botanical specimens of all the plants of the country. An appropriation for a Botanist was made by Congress, and an arrangement was made between Hon. Horace Capron, then Commissioner of Agriculture, and Prof. Joseph Henry, Secretary of the Smithsonian Institution, by which the botanical collections then in the possession of that Institution were transferred to the Department of Agriculture as a beginning toward the formation of an herbarium. Those collections were chiefly made under various surveys and explorations of the Government, as those of Commodore Wilkes, those of the Mexican boundary, and of the Pacific Railroad surveys, together with large contributions from foreign Governments. To these have been since added the plants collected under the different Geological

Surveys, and large quantities obtained by purchase from various botanical collectors in different parts of the country, and important additions by exchanges and contributions.

The herbarium has now grown to be one of the largest and most valuable in the country, and contains a representation of nearly all of our 12,000 native phænogamous plants, as well as large numbers from Mexico, South America, and other countries. These specimens are a necessity to the Botanist, in order that he may be able to distinguish and determine the names of the plants which are constantly being sent from all parts of the country to the Department for determination and investigation. It is, in fact, a kind of reference library, to be consulted whenever occasion requires. Well prepared botanical specimens are for purposes of comparison almost as useful as the living plants, so that the herbarium gives nearly all the advantages of an arboretum and botanical garden, accessible at all times, and much fuller in species than it is possible to have a living collection. The rapid development of this vast country is constantly bringing to light new kinds of plants, respecting which information is sought, and which has to be obtained through the medium of the herbarium.

The herbarium is also often consulted by teachers and professors of science, who avail themselves of the opportunity here afforded of studying plants from all parts of the United States. This advantage is also participated in by educated foreigners, who, in visiting the capital of the country, expect to find centered here a full representation of its various productions. Natural history collections are a necessity of the present age, and every country of the world, which is advanced in intelligence and science, makes its capital the headquarters for information relating to its resources and productions, thus fostering that spirit of research to which the progress of the world is so much indebted.

EXPOSITION WORK.

In 1876 the various Departments of the Government were called upon to contribute toward making a suitable display of their functions and operations at the Philadelphia Centennial Exposition. As a proper representation of the work of the Botanical Division the Botanist made an extensive exhibit of large sections of the various kinds of forest trees of this country, embracing between 300 and 400 different species, brought from all portions of the Union, the largest and best display of the kind that had ever been made in the United States. This collection was afterward returned to the Department and subdivided into smaller sets, most of which were distributed to our agricultural colleges and institutions of learning, and to foreign Governments which desired them.

The division has also been called upon to assist in making displays at other important expositions, as at Louisville, Cincinnati, and New Orleans, particularly at the last-named city, where a large collection of the grasses of the United States was displayed, intended to show how extensive are the resources of the country in this important element of wealth.

WORK ON GRASSES.

Investigations of the grasses of the country have been conducted for many years by the Botanist, with the purpose of bringing to view and into cultivation new kinds which might prove useful additions to the

agriculture of the country. In connection with this subject several special reports on our native grasses have been published by the Department and distributed among farmers and others. The principal of these reports, called the "Agricultural Grasses of the United States, with their chemical composition," is a pamphlet of 144 pages, with 120 full-page plates.

Another, entitled a "Descriptive Catalogue of the Grasses of the United States," containing 110 pages, was published in connection with the grass display at the New Orleans Exposition.

Recently a special bulletin, or report of an investigation of the grasses of the arid districts of Kansas, Nebraska, and Colorado, has been issued.

There is yet urgent need for investigation of our native grasses, particularly in the line of thorough and protracted experiments, to determine their productiveness and adaptation to peculiar climatic conditions.

In a country so extensive as ours, embracing such a variety of soil, surface, and climate, it cannot be expected that any one kind of grass will be adapted to cultivation in all situations. But private experiments of the kind needed are attended with much expense, and very few persons have the means or the time to prosecute them. But it is in the power of the Government to conduct investigations which will probably result in greatly extending our agricultural resources and contribute to the happiness and wealth of the people. Particularly in the arid regions of the West new kinds of grasses are needed, adapted to the peculiar conditions there existing.

We present here, from a mass of correspondence, extracts to illustrate the nature of the inquiries which are constantly received by this Department.

A correspondent writes from Alabama as follows:

I find in this vicinity a grass growing about residences and along roadsides, in bunches and patches, the value of which I would like to learn more about. From the places where I find it it would seem to be an important grass just getting a start in our lands. It grows well under trees, and in the shade equally as well as in the open ground, and, owing to the number and strength of its roots, it grows in hard and dry grounds. I find it green now, after an unusually long drought, when almost all other grasses are burned up. Its rooting capacity is very great: a man can only pull up a small bundle with his hands. I wish to know what is the name of the grass, and its probable value as a grazing grass.

The grass referred to was the *Sporobolus Indicus*, described on page 50 of the "Agricultural Grasses of the United States," and figured on plate 50. It deserves attention from Southern farmers.

From Texas comes the following:

I send you herewith a package of grass for which I have no name. This grass I consider the most valuable of all the grasses that I am acquainted with. It is perennial and grows here all the year round, furnishing excellent green feed for stock at all seasons of the year, except that the green blades freeze in our very coldest weather, perhaps two or three times a winter, and then they grow out again in a few days. It increases rapidly from seeds, and also reproduces itself from suckers, which sprout from the nodes of the culm after the first crop of seeds ripens. I have seen these suckers remain green six or eight weeks after the old stalk was as dead and dry as any hay, and then they take root and form new plants. It grows well in all kinds of dry land. The plants from roots from one to two or three years old form large stools from 12 to 18 inches across and have very strong roots, and grow in the longest drought almost as fast as when it rains. I am anxious to prove which are the most valuable grasses for cultivation, because I am confident that they are destined to become one of our most profitable crops.

The grass mentioned was *Paspalum dilatatum*, which is highly

recommended for cultivation in the South. It is described in the "Agricultural Grasses of the United States," at page 24.

Another, writing from California, says:

I find that there is an intense desire among farmers here to obtain a grass capable of resisting the intense heats of our summers, and also, if possible, one that should grow on poor soil. There is no grass known here that will thrive through the dry summers and autumns, affording grazing for cattle during that period. If such could be had it would simply revolutionize California agriculturally, as many districts are fast becoming worthless for want of some such resource. This arises from the system of continuous wheat cropping, to which the land has been subjected for the last thirty years without relief from rotation of crops, so indispensable to proper farming.

A correspondent, of Lampasas County, Texas, writes:

The Texas blue-grass, which you recommended, I have found in my yard. I observed it closely last winter, not knowing what kind it was until it bloomed. Now it has spread, by means of underground stolons, until I have quite a quantity of it. I also found it growing luxuriantly in the Colorado bottoms, about 20 miles from here. It spreads very rapidly, almost equal to Bermuda or curly mesquite. This, I think, is just the grass I have been looking for. We want grasses that will take care of themselves, and I think Bermuda for summer and Texas blue-grass for winter will answer every purpose. Of native grasses we have two kinds that excel all others. One is *Buchloe dactyloides*, known as curly mesquite, running mesquite, fine mesquite, and buffalo-grass. It is a good summer grass and fair for winter, as it is only partially killed by frost. The other grass is the *Stipa setigera*, known as bunch mesquite, winter mesquite, and big-bearded mesquite. It is, pre-eminently, the winter grass of a large portion of Texas, but of no value for summer. It is biennial, but usually thought to be perennial. This grass is found with the live-oak. For cultivated land Johnson grass, alfalfa, and Texas millet succeed well here. The Texas millet (*Panicum Texanum*) is undoubtedly the finest forage grass in existence. Horses, cattle, and sheep prefer it to any other kind of hay. It is a sure crop, and produces 2 or 3 tons per acre.

From Camden, Del., we have the following:

Inclosed please find a sample of what is here called an air plant. We have always been finding small patches of a few square yards in our clover fields, but that amounted to nothing, but in a lucerne patch it is very destructive. My own hay this year was absolutely unfit for bedding for stock. As the man who cut it remarked, you could stand at one end of the lot and move the grass at the other, so completely was it matted. I suppose it must have come in seed procured in California. How is the plant disseminated? What is it? Is there any prevention or remedy?

The plant spoken of above is a species of dodder (botanically, *Cuscuta*). It is a parasite, which first germinates in the ground and sends up a slender stalk, which attaches itself at once to green plants in its neighborhood, and thereafter draws its support from them by means of small suckers, which adhere closely to the surface. There are many species of dodder, some of which are parasitic upon only one particular kind of plant, as the flax dodder, the clover dodder, &c. In California there has been much trouble in fields of alfalfa from the presence of a kind of dodder, which, it is stated, was introduced with alfalfa seed from Chili, and this is probably the kind above complained of. The only prevention of the pest is to make sure of sowing only pure seed. The cure, when it gets into a field, will consist in cutting the crop before the dodder matures any seed, and repeating the process as long as the dodder makes its appearance.

From Chicago, Ill., comes the following inquiry:

I have heard of a strong-growing beach-grass that they have used with success in staying the shifting sand-dunes in the north part of Germany and Holland. We have some similar land at the south end of Lake Michigan on which we would like to experiment, if we knew the kind of seed and where to get it; something with strong roots, that would grow in pure sand, surviving strong winds and winter storms, would be a blessing to a large section of this country.

There are several grasses employed in Europe for the purposes above indicated, but chiefly the one which is botanically called *Amphiphila arundinacea*. It grows on the seacoast in Europe, and also in North America. It has no agricultural value, being quite too coarse for food for cattle. But the widely creeping and matted root-stocks serve to bind the sands and resist the encroachment of the waves. This grass has also been used at Provincetown, or Cape Cod, for the above purpose, and the harbor at that place was long preserved from destruction by the care which was taken in setting out this grass, through a committee appointed for that purpose.

A correspondent from Walsh County, Dakota, says:

The question of what is the best variety of grass to replace the native grasses, which are fast disappearing in this country, is one of vital importance to us. Clover has been a failure with us thus far; the frost destroys it so effectually that not a blade can be seen in the spring. Timothy has been only partially successful; a fair crop has been obtained the first year, but the second year it appears to get choked out by weeds and foul stuff. What we need is some variety that will stand the severe frosts of winter, produce a good crop of hay, and make a good, permanent pasture.

There is a very great and important necessity, not only for Dakota but for many other portions of the country, that experimental stations should be established for the testing of all kinds of grass and forage plants, in order to obtain such for cultivation as are proven to be adapted to the existing circumstances.

From Uvalde, Tex.:

Inclosed find a stalk of a wild grass which has made its appearance in Western Texas within a few years. It is a perennial grass, comes up in early spring and matures about the middle of May. It seems to be adapted to this dry climate.

This is a native grass, growing in most of the Southern States, in Texas, and extending west to California. In California it is known as California timothy, but is not there esteemed of much agricultural value. In the Southern States it has been cultivated to some extent, and is known in some localities as Gilbert's relief grass. Doctor Phares says that Mr. Stewart, of Louisiana, prefers this grass to others which he has tested, for quantity and quality, for winter and spring grazing, and for soiling for milch cows. There is much favorable testimony respecting the grass in the South, and it is deserving of extended cultivation.

Again, from Texas:

We send you this day, by mail, a bundle of grass. It is a true winter grass, coming up with the fall rains in October and November; is fine pasture all winter for horses, cows, sheep, hogs, &c. No freeze affects it here whatever. Seed ripens in April; it dies in May, and remains so until fall. Stock do not seem to relish it much until after frost. It forms a very thick mat or sod, and is spreading fast over our grounds. It kills out weeds that usually come up in the spring. Such a grass is worth millions to Texas for winter pasturage.

This is *Bromus unioloides*, which is sometimes called rescue grass, or Schrader's grass. A full account of it is given in the "Agricultural Grasses of the United States." Respecting this grass also another Texas correspondent says:

Inasmuch as Western Texas is the great stock-raising section of the Southwest and considering the fact that pasturage is scanty, particularly in February, thus stunting the growth of young cattle, this grass seems wonderfully adapted to supply just what is greatly wanted, both for milch cows, calves, colts, and ewes; and, besides, it grows well on the thinnest soil and crowds out weeds, while not interfering with the native mesquite. I therefore regard it as a wonderful and most important discovery.

From Putnam County, Arizona, we have the following :

This country contains millions of acres of land that seems adapted to no other earthly purpose than grazing, but the grass is so thin upon the ground that it takes many acres to maintain one cow, and cattle must be distributed very thinly along the water-fronts in order to have them thrive, because when feed is scarce they are obliged to travel too far, and are, consequently, poor in flesh and stunted in growth, whereas if all the land was well seeded to thrifty grass the same land could maintain three times as many cattle. We want to know if there are not some kinds of imported grasses that are good for our purpose, and that will grow in our climate, between 32° and 35° north latitude on the Pacific Slope. There is in this latitude rain only twice a year. The land is fertile, but lacks the proper kinds of grass to furnish sufficient pasturage. Are there not some kinds which might be imported from Arabia, or some country with a similar climate, which would be an improvement?

There are millions of acres of arid lands, of the character of the above described, for which the great need is the establishment of experiment stations in the arid districts, where many kinds of grasses and forage plants could be thoroughly tested on a large scale and under skillful and intelligent managers. Such experimentation would, undoubtedly, result in important practical benefits.

A correspondent, of Taylor County, Texas, writes as follows :

I have a body of land lying north of Fort Worth, in the black, sandy soil, also another in the Panhandle country, along the Upper Red River, among the red lands, which I am improving for agricultural and stock-raising purposes. I desire to obtain information as to what are, or would be, the best grasses for these regions, as the short, curly mesquite and sedge-grasses which abound, while being very nutritious are not of sufficient growth, and are not suitable for hay-making, nor will they support the number of stock to the acre that the soil would warrant.

Such inquiries as the above can only be partially answered at the present time for the want of proper investigations and experiments. By devoting a portion of the land to the cultivation of summer crops of such grasses as Hungarian, Texas millet, and sorghum it could be made safe to keep twice the quantity of stock. At the same time experiments should be made with permanent grasses, such as Johnson grass, Texas blue-grass, orchard-grass, and any others that give promise of utility, including even some of the thriftier and more productive native grasses of the region, as blue-joint and some of the *Panicums*.

From Savannah, Ga., we have the following:

In your "Descriptive Catalogue of the Grasses of the United States," page 11, it is stated that *Panicum maximum* (Guinea-grass), seldom matures seed in this country, and is usually propagated by division of the roots, and that it is too tender to be cultivated, except in the very warmest portions of our country. Doctor Phares, in his valuable book of grasses, states that whenever it has had proper care the crop is enormous, and in Jamaica, where it is cultivated extensively, it is held next to sugar in value of crop, and that the roots are easily killed by frost and must be protected in winter. For the information of your Department I beg to state that specimens of this grass have been growing in a garden here for several years; that the roots are uninjured by our frosts, and that the plants have borne seeds freely, and have been extensively propagated from these seeds.

Probably this valuable grass will prove hardy in the southern portion of the Gulf States and throughout Florida.

A correspondent from Missouri sends a specimen of plant, and says:

This morning a gentleman brought me a sample of a plant he found in a garden here that he suspects to be the Canada thistle. I inclose it for your inspection. We have considerable excitement about the Canada thistle, as many farmers are afraid it will get introduced. We have a law against allowing it to grow, and I am the prosecuting attorney, and wish to have information in regard to it.

In this case the plant sent was what is called sow-thistle, an annual spiny-leaved plant, but easily killed, and not inclined to spread.

The introduction of the Canada thistle may well be dreaded in any agricultural district.

From Inyo County, California, a correspondent writes:

Our cattle often eat something that is poisonous, and I am inclined to think that the plant I send herewith is that which poisoned them. The cattle swell up and die soon after eating the poison.

The plant sent was a species of *Cymopterus*, of low growth, akin to what is called poison parsley, but of its properties we know little. The same kind is frequently sent from Idaho and Wyoming, with the same complaint of its poisonous character. It makes its appearance early in the spring, before grass has become plentiful, and cattle eat it from hunger and not from choice. It is so abundant that its extermination would be difficult. If cattle were well provided with hay or fodder they probably would not touch it. Probably it produces *hoven*, like the effect of over-feeding on green clover.

From Bakersfield, Cal., comes the following respecting a poisonous plant known there as "loco":

It prevails quite abundantly over an extent of 150 square miles in this valley, and, I am informed, is found in other valleys of the State, and also in Arizona. This year the army-worm and a minute insect, which destroys the seeds, have killed a great deal of it; but, if not molested, it will soon flourish to as great an extent as ever. I think very few, if any, animals eat the loco at first from choice; but, as it resists the drought until other food is scarce, they are at first starved to it, and, after eating it a short time appear to prefer it to anything else. Cows are poisoned by it as well as horses, but it takes more of it to affect them. It is also said to poison sheep. As I have seen its action on the horse, the first symptom of the poisoning is hallucination. When led or ridden up to some little obstruction, such as a rail or bar, lying in the road, he stops short, and, if urged, leaps as though it were 4 feet high. Next he is seized with fits of mania, in which he is quite uncontrollable, and sometimes dangerous. He rears, sometimes even falling backward, runs or gives several leaps forward, and generally falls. His eyes are rolled upward until only the white can be seen, which is strongly injected, and, as he sees nothing, he is as apt to leap against a wall or a man as in any other direction. Anything that excites him appears to induce the fits, which I think are more apt to occur when crossing water than elsewhere, and the animal sometimes falls so exhausted as to drown in water not over 2 feet deep. He loses flesh from the first, and sometimes presents the appearance of a walking skeleton. In the next and last stage he only goes from the loco to water and back; his gait is feeble and uncertain; his eyes are sunken, and have a flat, glassy look, and his coat is rough and lusterless. In general, the animal appears to perish from starvation and constant excitement of the nervous system, but sometimes appears to suffer acute pain, causing him to expend his strength in running wildly from place to place, pawing and rolling, until he falls and dies in a few minutes.

We invite further information from those acquainted with the plant and its poisonous qualities.

The plants sent were those of *Astragalus lentiginosus*, locally called "rattle-weed" and "loco." It belongs to the order *Leguminosæ*, and is somewhat similar to lucern in appearance, and produces bladdery pods, in which the seeds rattle when ripe. Hence the name "rattle-weed."

In Colorado and New Mexico the same disease among horses and cattle is produced by the *Astragalus mollissimus* and other allied plants. The losses of stock from the eating of these plants has been very great.

From Wellborn, Fla.:

Inclosed I send you, for identification, a forage plant called here "beggar-weed." It is a nuisance in our cotton fields, yet all our planters are anxious to get it into their fields. It grows from 1 to 6 or 8 feet high. All kinds of stock eat it with greediness and fatten on it, and can work daily with nothing else. It has large, spreading roots, and I think it would enrich the ground as much as clover if plowed under. Persons sometimes go 20 miles to strip the seed to get a start.

This plant is a species of *Desmodium*, several kinds of which grow throughout the country, and are commonly called "beggar-lice," from their appearance and from adhering tenaciously to the clothing of passers-by. The species sent would not probably be hardy in the Northern States.

From Gainesville, Fla.:

Vanilla beans are quoted in New York at from \$7 to \$12 per pound wholesale. Can you inform me if the climate and soil of Florida are adapted to their growth?"

From Tucson, Ariz.:

During the past year I have discovered tobacco growing wild in the mountains of Arizona. Have you any record of the existence of wild tobacco in this region?

Several species of wild tobacco were cultivated by the Indians. One species (*Nicotiana rustica*) was cultivated by the Indians in New Mexico and Arizona, as observed by Dr. Ed. Palmer. Another species (*Nicotiana quadrivalvis*) was cultivated by the Indians from Missouri to Oregon. One or two other species are recorded as having been cultivated in California.

From Philadelphia, Pa.:

I wish to utilize a strong, white fiber which is furnished by the plant called "bear-grass," which grows in the Southern States. To do so economically and profitably requires that the plant should be found in large quantities in some particular locality. Can you inform me of any place where it grows in sufficient quantity for that purpose?

From Savannah, Ga.:

Can you give me the botanical name and description of the inclosed plant? It grows in a wild state in Brooks County, Georgia, and is known among the negroes as "poor man's salve," and a wonderful efficacy is claimed for it in curing old sores and indolent ulcers.

The plant is a species of *Croton*, which grows commonly in the Southern and Western States.

From Norfolk, Va.:

I send a few cork-oak acorns, grown on a tree produced from an acorn planted about 1860 or 1861. The original acorns came from Washington Patent Office, I think, and being planted just before the war were neglected, and only three of the five have lived, and they being too close together to develop. The largest tree is about 14 inches in diameter and about 20 feet high. This is the first year I have ever seen acorns. The cork is about $1\frac{1}{2}$ to 2 inches thick, and too porous for use.

A large quantity of these cork-oak acorns were distributed in the Southern States about the time mentioned above and many of them grew. Reports concerning such have been received from South Carolina and Georgia, where trees are probably still growing. No bark has yet been produced of sufficient thickness and compactness to be serviceable for the manufacture of corks.

From Titusville, Fla.:

I send you a package containing a plant that is said to be the best known specific for dysentery and all bowel complaints. It is said to be an old-time remedy in the Southern States. It is called "flux-weed." I will be thankful if you will give me the name and medical properties of the plant.

This is *Galium hispidulum*, a low, spreading plant of the order *Rubiaceae*. We have no knowledge of its medicinal properties.

From Texas:

I inclose a plant called "Indian blood-weed." Please identify and classify for me. It grows mostly along the foot of the "red hills" (which are ranges of flat hills containing iron). It was used by the Indians for purifying the blood and curing skin diseases. I have seen it used by the settlers and herders, who made a tea of it, which in all cases proves beneficial in curing sores or skin diseases in a short time.

The plant referred to is a species of *Ephedra*, a singular looking, leafless, or nearly leafless, shrub, growing in the southwestern arid districts. It is a popular remedy in those regions, and probably has active properties.

From West Virginia:

I send you a specimen of shrub which grows in mountainous situations in this State, and which is called mountain-tea. It is used as a substitute for ordinary tea of commerce, and is said to be as pleasant and agreeable to the taste as that article. Please inform me of its botanical name.

The plant is botanically called *Comptonia asplenifolia*, growing abundantly in the Northern States, where it is called "sweet-fern." There are a number of other substitutes for tea employed in different parts of the country, as, *Ceanothus americanus*, or New Jersey tea; *Sida stipulata*, a small malvaceous plant; *Ilex cassine*, the black tea of South Carolina, and others.

From Burnet County, Texas:

This day I send you by mail a species of a grass which is our best forage plant for winter pasture. It grows rapidly all winter, and is ready to go to seed in April. Stock of all kinds are very fond of it. It is never killed or even injured by cold in the winter. The seeds are large enough to be ground, and probably would make good breadstuff. Please let me know the name of the grass.

The grass is *Bromus unioides*, a native of Texas and the Southwest, and is undoubtedly one of the most valuable of grasses for winter pasturage in that region.

From an Army officer in Montana, transmitted by the Quartermaster-General:

I have the honor to send herewith samples of a weed found among the wild-grass hay delivered here under current contracts. In small quantity it appears to do no harm, but when present in greater amount among hay cut in creek bottoms, particularly in swampy spots, it causes griping and spasmodic action in the legs, followed by looseness in the bowels and general weakness. Mules and horses avoid eating it as much as possible, but farmers assert that cows do not mind it and eat it with impunity. I would be glad to have the name and character of the plant determined.

The plant sent with this communication proved to be *Smilacina stellata*, a common plant in mountainous regions, especially in the Northern States and Rocky Mountains. It is related to the *Convallaria* or the lily of the valley, so called in cultivation. We have no previous record of the peculiar properties noted in the above instance.

From Ennis, Tex:

Inclosed we send you a twig of a shrub which abounds on some of the hills of Central Texas, and is commonly known as prickly currant. As you will observe, it resembles holly, and we think it must belong to the same family. Will you kindly determine its botanical name, and let us know at your earliest convenience?

The specimen sent belongs to a species of barberry peculiar to Texas and the Southwest, the botanical name of which is *Berberis trifoliata*. The leaves are thick and spiny-toothed, somewhat like the holly, but much smaller. The bush, which is 3 or 4 feet high, is very spiny, and has bunches of red fruit somewhat like the currant in appearance.

From Fremont County, Wyoming:

Please let me know if you have or if there is any grass seed such as will grow in this climate. The climate is dry and the altitude high, and in the summer months there is a scarcity of water; consequently we cannot raise hay, and wild grass, by being pastured so much, seems to grow shorter every year. The soil is good, but sandy. We want a grass that will grow in such a climate and make a good hay, even by irrigating in the spring as long as water lasts.

From a seed-merchant, Chicago, Ill.:

Kindly name the inclosed specimen, and let me know what it is as soon as possible.

From Spartanburg, S. C.:

I send you herewith a pod of a plant growing in this State having an abundance of fine, silky hairs attached to the seed. I would like to know if this fine delicate fiber can be utilized in any way. I think the plant also possesses medicinal properties, and would be glad to know if such is the case.

The pod belongs to a kind of milkweed, botanically called "*Asclepias tuberosa*," or, popularly, "pleurisy root," because it is employed in cases of pleurisy and other diseases. The silky fibers of the seeds are like those of all the milkweeds, of which there is a large number of species, and the inquiry as to its economic use is often made; but, although very delicate and beautiful, it lacks tenacity, and cannot be spun by itself into a thread.

From Florida:

We are alarmed here at the appearance in our fields and orange groves of what is called "nut-grass," and which bids fair to double our labor in cultivation. Tearing up by the roots and even sifting the soil have proved of no avail in getting rid of it. May I beg that you will indicate as soon as possible the best and quickest means for its destruction?

The nut-grass, or coca as it is also called, is one of the worst pests of agriculture in the South. The botanical name is *Cyperus rotundus*. Mr. Elliott, in his "Botany of South Carolina and Georgia," says of this sedge:

It is becoming a great scourge to our planters. It shoots from the base of its stem a threadlike fiber, which descends perpendicularly from 6 to 18 inches, and then produces a small tuber. From this horizontal fibers extend in every direction, producing new tubers at intervals of 6 to 8 inches, and these immediately shoot up stems to the surface of the earth and throw out lateral fibers to form a new progeny. This process is interminable, and it is curious to see what a chain or network of plants and tubers can with some care be dug up in loose soil. The only process yet discovered by which this grass can be extirpated is to plow or hoe the spots in which it grows every day through a whole season. In their perpetual efforts to throw their leaves to the light the roots become exhausted and perish, or if a few appear the next spring they can easily be dug up. This experiment has been successfully tried by John McQueen, esq., of Chatham County, Georgia.

This account was written more than sixty years ago. The method given for destroying the pest is applicable to the present time, and is perhaps as good as any one known.

From editor of the Courier-Journal, Louisville, Ky.:

Inclosed we hand you a specimen of a plant received from a correspondent at Salem, N. C. Please name it for us, and give any information which there may be about it of any special interest.

From the commissioner of agriculture for Georgia:

I will be obliged to you if you will name the grass of which I inclose a specimen, stating its economic value. The grass grows in bunches in fence corners, stems from 5 to 7 feet high, leaves from 8 to 12 inches long. It is sent to me from Washington County in this State.

FOREIGN INQUIRIES, ETC.

From the Government Botanical Gardens at Saharamper, Northwestern India:

I am just now studying the grasses of Northern India with special reference to their relative value for forage or fodder, and as many of our best kinds occur also in America, the information given in your book ("The Agricultural Grasses of the

United States") is of very great value. In Upper India we have extensive tracts (called usar land) devoid of cultivation, owing to an excess of saline ingredients in the soil (salts of soda). There are two or three kinds of grass which apparently thrive in such soil, one of which, called "usar grass" (*Sporobolus tenacissimus*), represents the only vegetation over extensive areas of this usar land; the other grasses which affect usar in less abundance are *Eragrostis ciliaris* and *E. cynosuroides*. The *Sporobolus* appears to be a good fodder grass, as it is greedily eaten by cattle. I can not help thinking that it would be well worth while trying to introduce from other countries any species known to thrive in saline soil, and I should be extremely obliged if you could put me in the way of obtaining the seed of such kinds.

The usar grass above referred to is, according to a figure of the plant in "Illustrations of the Forage Grasses of Northwestern India," very closely related to our *Sporobolus cryptandrus*, which abounds on the arid plains of the West.

From Timaru, New Zealand:

Noticing in an Australian paper an account of some of your native grasses, which would seem to be desirable to add to present varieties in New Zealand, I take the liberty of writing you upon the subject. Unfortunately our native grasses are nearly all delicate, fine annuals, which disappear before heavy stocking. The prevailing grass or tussock (*Poa australis*) is a wiry, hard grass, that yields no feed except when burned in spring and the tender, green shoots spring up. Thereafter it becomes a hard, wiry bunch-grass, that sheep never eat, and seems to serve for shelter to the finer sorts. There appears plenty to eat, but sheep do not touch it unless starvation drives them. Cultivation has driven out the native grasses, and those sorts common to England are in use here. We want varieties which might thrive here. The only one yet that does is Kentucky blue-grass.

From Prussia, Europe:

I have for a number of years been experimenting with various plants at the Agricultural Institute of the Halle University, and would like to do the same with the native buffalo-grass of the United States, which is illustrated and described in the Annual Report of the Commissioner of Agriculture for the year 1880. I have not been able to get the seed in Europe.

RELATION TO OTHER BRANCHES OF THE DEPARTMENT.

The natural sciences are intimately related to and dependent on each other. The plants which are the care of the Botanist are often subject to the destructive depredations of insect foes, and the aid of the Entomologist has to be obtained to learn the name and history of such insects. Again, the Botanist and the intelligent cultivator of plants find that insects have much to do with the fertilization of plants, and that without their aid, in many cases, the production of fruit would be much diminished or entirely fail; in other words, success in certain crops is largely dependent on the good offices of these insect friends. In such instances as these botany and entomology come into close connection.

The Chemist is often required to make an analysis of plants or vegetable products having medicinal or poisonous properties, and he finds it important to know the name, botanical character, and affinities of such plants or products, and for that purpose calls in the aid of the Botanist. The Ornithologist may be pursuing investigations into the food habits of birds to ascertain which are granivorous, and which are insectivorous. He finds that he needs the assistance of the Botanist in identifying the seeds and grains which he finds in the stomachs of his birds.

Thus each division of the Department is an aid to the other, and the development of each is required not only for its own work, but also for the aid which it may furnish the others. The following statement

from the Division of Entomology indicates how botany aids that science:

Very frequently insects are sent to the Division of Entomology for determination and report, accompanied by specimens of their food-plants. The latter are frequently in a fragmentary condition, and when known to the sender are known only by some local name. In such cases as this it is our custom to consult the Botanist, and the information which we obtain from him is of material aid to our own division. The two divisions are, in fact, closely related in their work.

The Chemist states as follows:

The relations of the Botanical to the Chemical Division are of the most important nature. A large part of the plant material which is sent to the Chemist must be accurately identified by the Botanist before being submitted to analysis, in order that there may be no doubt as to the exact species examined. The data are thus preserved for the future and accurately fixed as relating to some particular plant. On the other hand, this identification prevents the repetition of an analysis, by making it possible to search for previous analyses of the known species in hand.

In studies of the adaptability of plants to climatic condition the Chemist and Botanist work hand in hand, and in all the analytical investigations which are undertaken by the Chemical Division the confidence that their results are applied in the right places is due to the certainty derived from the identifications of the Botanist.

As an example of the manner in which the two divisions work together may be cited the studies at present being made of one of the prickly pears of Texas, which is attracting attention as of value for stock. The Botanist's knowledge as to the growth and distribution of the plant and his observations of its habits of growth are a necessary complement to the chemical study of its food value.

With an increased force the fields which the Botanical Division might enter in conjunction with the Chemical would be numerous.

The relations of the Botanical to the Seed Division are becoming increasingly important. In the purchase of seeds for distribution the Botanist's knowledge of the natural habits of a plant is essential to the determination of its probable agricultural value. Some of the native grasses investigated by the Botanist have been introduced into cultivation through the Seed Division, and further work of the kind is needed to supply the demand for grasses adapted to different parts of the country. Every year the aid of the Botanist is required to determine the purity of seeds purchased by the Seed Division for distribution.

The relation of the Botanical to the Horticultural Division is too obvious to require mention. The greenhouses and grounds are a constant source of supplies to the herbarium, and each division is an aid to the other in many ways.

INVESTIGATION OF FUNGOUS DISEASES.

At the last Congress an appropriation was made for the investigation of the fungous diseases of plants, such as mildew, smut, blight, grape-rot, potato-rot, &c., and for experiments necessary to determine suitable remedies for those diseases. The mycological section has accordingly been organized, and is conducting investigations in this line of work which will, it is hoped, result in great good, by preventing the immense losses which farmers and horticulturists are subject to by the frequent occurrence of those diseases. Special bulletins on the subject will be published for general distribution.

DIRECTIONS TO CORRESPONDENTS.

In order that the division may be more useful to those who consult it, the following directions regarding plants for identification are inserted. Plants are often received by the Botanist for name in so

imperfect a state that the desired information cannot be given. Additions to the herbarium are constantly being made of even ordinary plants, for the purpose of exchange, &c., and when not of further use to the sender specimens sent are often added to the herbarium, and it is desirable to have them suitable for the purpose.

PERFECT SPECIMENS.

Not every plant can be recognized at sight even by botanists; but any plant which has been described and named can be identified if perfect specimens are furnished. In the case of new plants, which are still occasionally found, it is especially important to have good specimens, in order that they may be classified and named.

Sometimes perfect specimens cannot be obtained at the time information is wanted. In such cases whatever can be had may be sent and may prove sufficient, but as full a description as possible should be given of the parts not obtainable.

A perfect specimen includes all parts of the plant or samples of all parts, though some parts are more important in identification than others. The flower is the part usually most essential; any other part can better be wanting than this, and in most cases this is furnished. With all plants, however, the fruit is also important, and many cannot be determined without it. Dry fruits require less care in preparation than flowers, are less likely to be injured, and are more easily examined. Notwithstanding these facts, the specimens received at the herbarium from both botanists and others are much more frequently defective in the fruits than in the flowers. The leaves are always important and are seldom omitted, but in many herbs the radical leaves, or those from the base of the stem, differ in form from the others, and these are not always furnished.

In some plants certain parts are more important for identification than the same parts in other plants. With herbs it is important to know whether they are annual, biennial, or perennial. To determine this requires the root as well as stem. If this is not furnished, the duration of the plant should be stated. With sedges it is essential to have the full-grown fruit, though desirable to have the flowers also. The habit of growth in sedges, whether singly or in tufts, is a distinctive character, which the specimens should show. With grasses it will usually be sufficient to gather specimens soon after flowering, though if some be in flower and others ripe it is better. The difficulty with fully-ripe grasses is the liability of the seeds and chaff to scatter. The rooting portions of grasses should also be furnished, as this is especially important in determining their agricultural value.

PREPARATION OF SPECIMENS.

It is not necessary to have living specimens for identification. Properly dried plants are nearly as good. They can be more easily and safely transported, and may be examined at any time. If dried quickly under pressure, in the manner of herbarium specimens, they retain essentially their original shape, something of their color, and do not become brittle, as when dried in the open air.

In drying, the plants should be placed between folds of absorbent paper (newspaper will answer) and subjected to a pressure of 25 to 50 pounds, according to nature of the specimens and the amount under pressure. As the papers become damp the plants should be removed

to fresh ones. This should at first be done as often as once a day. If considerable paper is used the plants will require to be changed less frequently and will be less likely to become discolored if neglected.

Plants should be gathered when dry, and preferably in dry weather. In the collection of specimens botanists commonly carry drying papers into the field and place the plants in them as soon as gathered, holding them in place by straps. When this is not convenient a tin collecting case is often used, which keeps the plants from wilting until they can be placed in the drying papers. A very good substitute for such a case is ordinary paper, in which the plants may be wrapped as gathered. In placing the plants in the papers to dry, have but one kind on a sheet, and place with it at once a label bearing the date and place of collection, with the name, if known, and any other particulars desired. Fleshy plants will need to be divided to dry properly, and thick specimens to prevent them occupying too much space. Seeds may be placed in an envelope and deposited with the remainder of the plant.

SOME NATIVE CLOVERS.

There are in the United States 40 species of native clovers (*Trifolium*).

The larger number of these belong to the Pacific side of the continent, and to Utah, Idaho, and Montana; a few species belong to Texas and the Southern States, two or three of which extend northward in the States adjacent to the Ohio and Mississippi Rivers.

None of our native species have been cultivated so far as is known, although several of them are of as large and vigorous growth as the common red clover, and are worthy of trial, as they may prove better adapted to some soils than that species. We give descriptions and figures of the most promising ones, and suggest that in the sections where they grow they should be subjected to experiment.

Trifolium fucatum.

This is one of the largest and strongest growing of our native kinds, and is found on the Pacific coast. Under favorable circumstances it attains a height of 2 to 3 feet. The stem is decumbent, smooth, thick, and juicy. The stipules at the base of the leaf are half an inch to an inch long, ovate, broad, and clasping the stem. The leaves are trifoliate, with stems or petioles 3 to 6 inches long; the leaflets vary from roundish or oblong to obovate, thickish, strongly veined, three-fourths of an inch to an inch and a half long, and with numerous small, sharp teeth on the margins. The flower heads are large (1 to 2 inches in diameter), larger than those of the common red clover on naked peduncles (stems), which are longer than the leaf-stalks (sometimes 5 to 6 inches long). There is a conspicuous green involucre surrounding the base of the flower head deeply divided into 7 to 9 ovate, entire, and pointed lobes, which are about half as long as the flowers. The heads contain comparatively few flowers (about 8 to 10), but these are about an inch long, thick and inflated, the calyx about one-fourth as long as the corolla, which varies from pink to purple in color. Mr. S. Watson, in the "Botany of California," says of this: "A common species in the Coast Ranges and in the foot-hills of the Sierra Nevada, through the length of the State—in some places very abundant and affording good pasturage." It would seem very desirable that this species should be given a fair trial in cultivation. (Plate I.)

Trifolium megacephalum (Large-headed clover).

A low species, seldom reaching a foot in height, but robust and with strong, deeply penetrating roots. A number of stalks usually proceed from one root, but these stems are unbranching, somewhat hairy, and terminate with a single large head. The leaves mostly proceed from the base of the stem, there usually being but one pair on the stalk near the middle. The lowest leaves are long-stalked, and with 5 to 7 leaflets instead of 3, as in most clovers, but the upper ones are sometimes reduced to 3 leaflets. The leaflets are an inch long or less, somewhat wedge-shaped or obovate and blunt at the apex, and with very fine, sharp teeth on the edge. The stipules at the base of the leaves are large, mostly ovate in form, and sharply toothed or deeply cut. The heads are mostly terminal, about $1\frac{1}{2}$ inches long, on a naked peduncle, and without an involucre. The flowers are large, purplish, about an inch long, and very compact and spicate in the head. The calyx, with its long, plumose teeth, is half as long as the corolla. This species grows in the mountain region of California, Oregon, Washington Territory, Nevada, and Montana. It is not as large as the common red clover, but experiments are needed to determine its possibilities for pasturage. Its large, showy heads and its peculiar leaves would make it an interesting ornamental species. (Plate II.)

Trifolium involucreatum.

This is an annual species, presenting a great variety of form, but under favorable circumstances reaching $1\frac{1}{2}$ or 2 feet in height and of vigorous growth. The stems are usually decumbent and branching below, very leafy, and terminating with 1 to 3 heads on rather long peduncles. The leaves are on stalks longer than the leaflets, which are in threes, one-half inch to an inch long, of an oblong or obovate form, smooth, and with very fine, sharp teeth on the margins. The stipules are large, ovate, or lanceolate, and usually much gashed or deeply toothed. The heads are long-stalked, about an inch long, the purplish flowers closely crowded, and surrounded with an involucre, which is divided into numerous long-toothed lobes. The flowers are half to three-fourths of an inch long, slender, with a short, striate calyx, the teeth of which are very slender, entire, and pointed, and little shorter than the corolla. This species has a wide range of growth in the western part of the continent, prevailing from Mexico to British America through the mountain districts. Under cultivation it would probably produce a good yield of fodder, but has never been subjected to experiment so far as known. (Plate III.)

Trifolium stoloniferum (Running buffalo clover).

This is a perennial species, growing about a foot high; long runners are sent out from the base, which are procumbent at first, becoming erect. The leaves are all at the base, except one pair at the upper part of the stem. The root leaves are long-stalked, and have three thinnish obovate leaflets, which are minutely toothed. The pair of leaves on the stem have the stalk about as long as the leaflets, which are about 1 inch long. The stipules are ovate or lanceolate, pointed, and entire on the margins, the lower ones nearly an inch long, the upper ones about half as long. There are but one or two heads on each stem at the summit, each on a peduncle longer than the leaves. The heads are about an inch in diameter, rather loosely

flowered, each flower being on a short, slender pedicel, or stem, which bends backward at maturity. Each flower has a long-toothed calyx about half as long as the corolla, which is white, tinged with purple. This species is found in rich, open wood-lands and in prairies in Ohio, Illinois, Kentucky, and westward. It is smaller in size and less vigorous in growth than the common red clover. (Plate IV.)

Trifolium Carolinianum (Southern clover).

A small perennial clover, having much resemblance to the common white clover. It usually grows from 6 to 10 inches high, somewhat pubescent, the stems slender, procumbent, and branching. The leaves are trifoliate, on petioles of variable length. The leaflets are about half an inch long, obovate, wedge-shaped at base, and somewhat notched at the summit. The stipules are nearly as long as the leaflets, ovate or lanceolate, and slightly toothed above. Each stalk has usually two long-stalked heads, proceeding from the upper joints. The roundish heads are from one-half to three-fourths of an inch in diameter, without an involucre, and with numerous crowded, small flowers on slender pedicels, which become reflexed in age. The long lanceolate teeth of the calyx are slightly shorter than the small, purplish, pointed corolla. The pods are usually four-seeded. This species occurs in all the Southern States and in Texas. It is too small to be valuable for fodder, but is worthy of trial as a constituent of pastures in the South. (Plate V.)

WEEDS OF AGRICULTURE.

The majority of our most troublesome weeds are plants introduced from other countries. As a locality becomes cleared up and brought into cultivation the character of the spontaneous vegetation always undergoes marked changes. Many of the native plants disappear, others become more abundant, and new plants introduced from foreign countries, or other parts of the same country, frequently become the prevailing vegetation.

Owing to the conditions of modern commerce and the natural provision for their distribution it is practically impossible to long exclude outside weeds from any considerable district. The weed laws of various States have done much to call the attention of agriculturists to the most troublesome weeds, and have in many cases retarded their introduction and distribution, but it is not to be expected that through any agency our worst weeds will become so subdued as to require no further attention. An account like this can only furnish the means of recognizing some of the more pernicious ones, and give some account of their origin and methods of propagation, with suggestions for keeping them in check or eradicating them for a time.

If the plants troublesome in cultivated crops were only such as were always and everywhere recognized as weeds, the question would be much simpler. Unfortunately many of our worst weeds were first introduced as useful plants. A large number have escaped from flower gardens, as Indian mallow, toad-flax, and daisy. Many plants are useful in one locality, but known only as weeds in another. Cock's-foot (*Panicum crus-galli*) is a coarse grass, very troublesome in gardens in many Northern States, but in the South it is a valuable fodder plant. Besides these, there are plants of common cultivation which act as weeds, and are difficult to eradicate when it is

desired to grow other plants. Kentucky blue-grass, one of the most valuable forage plants known, is quite difficult to subdue, owing to its creeping root-stocks. On this account many farmers aim to exclude it from their farms, preferring such plants as clover and timothy, which, though inferior in some respects, are more easily subdued.

The following general hints on the destruction of weeds may be found of use. Whether it be profitable to attempt the complete extermination of weeds will depend on the price of land and labor, the kind of crops to be grown, &c. There can be little doubt, however, that the more troublesome perennial and biennial weeds can usually be eradicated altogether with profit, especially where they are not yet abundant:

HINTS ON KILLING WEEDS.

1. Plants cannot live indefinitely deprived of their leaves. Hence preventing their appearance above the surface will kill them sooner or later.

2. Plants have greater need for their leaves, and can be more easily killed in the growing season than when partially dormant.

3. Cultivation in a dry time is most injurious to weeds and beneficial to crops.

4. Avoid the introduction of weeds in manure or litter or from weedy surroundings. Some gardeners use no stable manure on grounds they desire to keep especially clean, relying on commercial fertilizers and the plowing under of green crops.

5. After a summer crop has ripened, instead of allowing the land to grow up to weeds it is often well to sow rye or some other crop to cover the ground and keep them down.

6. Give every part of the farm clean cultivation every few years either with a hoed crop or, if necessary, with a fallow.

7. It is often stated that cutting weeds while in flower will kill them. This is only reliable with biennials, and with them only when done so late that much of the seed will grow.

8. If the ground is kept well occupied with other crops weeds will give much less trouble. Keep meadows and roadsides well seeded and plow-land cultivated, except when shaded by crops.

Cnicus arvensis (canada thistle).

This thistle grows usually to the height of 2 or 3 feet, the stems very leafy and much branched, with the flower-heads gathered into small clusters at the end of the branches. The stem and branches are not-winged by decurrent leaves, as they are in many other species. The leaves are comparatively small, those of the stem being mostly 3 to 6 inches long, about half an inch wide in the main part, with three or four prominent lobes on each side, and armed on the edges with an abundance of sharp, rather stiff, prickles, which are 1 or 2 lines long. The heads of the flowers are mostly less than an inch high, with a close involucre, the small scales mostly without prickly points. The flower-heads are mainly dioecious; that is, those of one plant are male only, while those of other plants are female only. The plant has creeping root-stocks, which spread deep beneath the surface and send up new stems, thus multiplying the plant. Although this plant is called Canada thistle, it is really a native of Europe, and has been intro-

duced into this country, probably first into Canada and from thence into the United States.

The Canada thistle nearly or quite fails to seed in many localities, spreading chiefly by the running root-stocks, so that it is not very rapidly disseminated. The failure to seed is doubtless mainly due to its dioecious character, as, if completely so, no seed would be formed where a patch originated from a single plant. It is not yet troublesome to any extent beyond the Eastern and Middle States. It prefers a heavy soil, but on such land is most easily killed. In pastures, or wherever the land is compact, if only a few plants appear they may often be killed by pulling them up a few times. Larger patches should be plowed deeply about once a week in the growing season, or each time before any plants appear above the surface. After each plowing rolling is advantageous, especially on sandy soil. There are numerous instances where fields of this weed have been completely killed in a single season in time to sow winter wheat. Cases have been reported of Canada thistles being killed by a single cutting at a certain period of growth. In some of these instances at least the plant has proved to be some other thistle. If the characters above given are borne in mind, especially the fact of the creeping root-stocks and of its growing on dry land, there will be little danger of this mistake.

Plate VI, Fig. 1, a portion of the stem, leaves, and flower-heads; Fig. 2, a portion of the running root-stock; Fig. 3, a single flower, with the seed and pappus.

Arctium Lappa (burdock).

A well-known biennial plant of the natural order *Compositæ*, which, like many of our common weeds, has been introduced from Europe. It has a thick branching stem, 3 to 5 feet high, with roundish heart-shaped leaves 3 inches to a foot or more long, the lowest on long stout stalks, the upper ones nearly sessile, the margins undulate and sometimes erosely toothed. The flower-heads are roundish, about an inch thick, mostly in small clusters at the ends of the branches. The scales of the involucre are extended into hooked points, which adhere to the clothing or to the hair or wool of animals. Within the involucre are a number of slender purplish flowers, each containing anthers and styles of the kind peculiar to this order, and at the base of each flower is the seed, surmounted with a number of slender bristles.

There are several varieties of this species, differing in the size of the heads and in other points, which varieties are by some called "species." It gives but little trouble in cultivated land, being found in waste places about buildings and fences, and occasionally in meadows where the seeding is thin. It prefers strong soil, and its presence is considered a sign of good land. Though not a serious weed in cultivated crops, its unsightliness and the annoyance of its burs in the wool and hair of animals make it desirable to try to exterminate it, especially as it is one of the easiest weeds to get rid of. One of the best times to destroy it is in the fall when the leaves are conspicuous and time is less pressing. It is killed any time if cut below the crown. It may also be killed by being mowed when the seed has fully formed, and the tops burned. If cut while in flower, as sometimes recommended, a second crop of seed will generally be produced.

Burdock has some reputation in medicine as a blood purifier and for rheumatism. Its value is probably slight. It is known in England as hare-burs or hurrburr, and the young shoots, after being stripped of

their rind, are occasionally used as a substitute for asparagus! In Japan it is cultivated under the name of gobo, the root, growing to 3 or 4 inches in diameter and often 2 feet long, being used much as we use salsify.

Plate VII, Fig. 1, a branch of the small variety; Fig. 2, a single flower magnified; Fig. 3, a portion of the large-headed variety—*major*.

Xanthium Canadense (clot-bur, cockle-bur).

A coarse branching annual plant of the order *Compositæ*, usually 1 to 3 feet high, with alternate, rough leaves from 3 to 6 inches long and about as wide, somewhat lobed and coarsely toothed, strongly three ribbed, somewhat heart-shaped at the base, and on long stalks. The flower-heads are in small axillary and terminal clusters of 2 kinds, male and female, the male heads on a short spike at the summit and the female in clusters of 2 or 3 at the base of the male spike. The male or staminate flowers are in roundish heads, with a thin scaly involucre. After shedding the pollen these heads soon drop off and disappear, and the female heads enlarge, and become thick, hard, oblong burs about an inch long, beset with stiff hooked prickles. At the apex of the bur there are two hard and sharp or hooked beaks, and within are two cells, each containing a single seed. Those who are accustomed to look at the aster and the sunflower as representatives of the order *Compositæ*, will not at first recognize this plant as a member of that family because of the separation of the male and female flowers, but a close examination will reveal its true position.

This plant is most abundant on low pasture and stubble land and along streams, though often growing rankly in waste places on upland. It is seldom a troublesome weed in crops, but its burs are a great annoyance in the fleeces of sheep. Seeding to clover and meadow grass and mowing several times the first season is recommended for its destruction.

We have figured this species (*X. Canadense*), believing that it is the one which is troublesome in corn fields and roadsides in the Western States, where it is probably native, but perhaps introduced from the South through travel and commercial intercourse. The species which occurs in the Eastern States is probably *Xanthium strumarium*, which is supposed to be a native of Europe and India. It is smaller in size, with smaller burs, more slender and smoother prickles.

Dr. Gattinger, of Nashville, Tenn., states that some twenty-two years ago he fed his horse quite a quantity of the *Xanthium Canadense* in its flowering season. It possesses an aromatic smell, and his horse liked it. It did not have any noxious effects upon him, although he has since heard a farmer say that it was poisonous to stock, which, however, he does not believe.

Plate VIII, Fig. 1, a branch, showing the spikes of male flower-heads, with the female clusters below; Fig. 2, three mature burs.

Ambrosia artemisiæfolia (rag-weed, bitter-weed, hog-weed, Roman wormwood).

A common annual weed of the natural order *Compositæ*, generally 2 to 3 feet high, rather slender, and much branched. The leaves are from 1 to 4 inches long, mostly alternate and thinnish, pinnatifid, or cut into deep narrow lobes, which are again lobed or toothed. The ends of the branches bear the flowers, which are of 2 kinds, male and female. The male flowers are in small heads of 5 to 8 to-

gether, inclosed by a 5-toothed green involucre. These heads are arranged in a slender, spikelike raceme 2 to 3 inches long, each one nodding on the very short recurved pedicel. At the base of the raceme are a few female flowers, which are erect, some of which develop into small hard nutlets or fruits. The flowering spikes are quite variable, sometimes being nearly all male, and sometimes mostly or entirely female. It seems to be an American weed, native of the warmer parts of the continent, but by cultivation introduced and spread over the United States and Canada.

It is very common in wheat-stubble and along roadsides. In Ohio it was reported to the State experiment station in 1883 by the greatest number of correspondents as the most troublesome weed in corn. It thrives on all soils, and can be eradicated only by the most careful cultivation. It is kept down in well-seeded meadows, but some of the plants persist, and produce seed when but a few inches high. Sheep are a valuable stock to keep on land infested with this and other weeds.

Plate IX, a branch with the flowering spikes; Fig. 1, a single male head; Fig. 2, a fertile nutlet.

Chrysanthemum leucanthemum (white daisy, ox-eye daisy, white-weed).

A perennial plant, 1 to 2 feet high, simple or with few branches, often several stems from one root. The stem is rather sparsely clothed with narrow, coarsely-toothed or gashed, obovate or spatulate leaves, the upper ones sessile with a clasping fringed base, the lower ones more or less petioled. The main stem and the few long branches are each terminated with a single head of flowers, which, when expanded, is an inch to an inch and a half in diameter. There is an external set of thinnish scales, which is called the involucre; within this are the florets, or flowers, of 2 kinds—an outside row of showy, white flat florets called “the ray,” and a central mass of short tubular yellow florets, which constitute the “disk.”

Both the ray and disk florets are fertile; that is, provided with an achenium or seed at the base. If the small disk florets are carefully examined they will each be found to contain 5 stamens united by the anthers around the central style. In the ray florets the stamens are absent. The plant is a native of Europe, but has become widely spread over all the eastern part of this continent.

The daisy is most troublesome in meadows and pastures. Though long known in this country, it is still spreading westward into new localities. In some cases it has escaped as a weed from flower gardens; in others it is introduced in grass or cloverseed or hay. It has been introduced in some places as a grazing plant for sheep, though the close grazing of the sheep will exterminate it. Where the plant is abundant it has been utilized to restore worn-out land too poor to grow clover. For this purpose it is sown at the rate of one-fourth bushel per acre. It is too much of a weed, however, to be introduced into a new locality for any purpose. If the land is brought to the proper state of fertility grass and clover will keep the daisies down, so that the few which remain may be readily exterminated. (Plate X.)

Abutilon avicennæ (Indian mallow, velvet-leaf).

A coarse annual plant of the order *Malvaceæ*. The stem is branching and grows to the height of 4 or 5 feet. The stem, branches, and leaves are covered with short soft hairs; hence the name of velvet-

leaf. The leaves are roundish-ovate, 3 to 6 or more inches long, and rather long-pointed, heart-shaped at the base, the margins with fine blunt teeth, and with a stalk longer than the leaf. There are about 5 principal nerves diverging from the base.

From the axil or angle of each leaf-stalk is produced a flower-stalk, which develops 1 or 2 flowers or is sometimes extended into a branching raceme, with 3 to 5 flowers. The flowers consist of an outer calyx, cleft into 5 lobes or teeth, the corolla consisting of 5 obovate orange-yellow petals, and a column of numerous stamens united into a tube, which closely surrounds the 12 to 15 styles. The expanded flower is half to three-fourths of an inch in diameter. After the fall of the corolla the ovaries develop into a crowded mass of dry pods or capsules, each one having 2 short stiff points or teeth, which spread or radiate upward and outward. The base of this mass of carpels is surrounded by the persistent calyx. The calyx and capsules are soft, hairy, or pubescent.

In some parts of the country this plant is called stamp-weed, because the pods are used to ornament or stamp butter.

This plant, originally from India, has spread quite extensively in Europe and Asia, and also in the United States, where in some localities it has become a serious weed in rich cultivated grounds. It was long sold as an ornamental plant; but few, if any, seedsmen now offer it. It possesses a strong fiber, which some have attempted to utilize for manufacturing purposes. (See Report 1879, p. 508.) Being an annual, and easily recognized, and generally confined as yet to limited localities, it would seem to be more easy to get rid of than many of our weeds. (Plate XI.)

Solanum Caroliniense (horse-nettle).

A low, perennial plant, with deep, running roots, belonging to the order *Solanaceæ*, the same that contains the potato, tomato, &c. The stems are 1 to 2 feet high, rather straggling, branching, and half-shrubby at the base. The stems and the midnerve of the lower side of the leaves are more or less thickly armed with short, sharp, stout, yellowish prickles. The stem and leaves are also covered with minute star-shaped hairs of from 4 to 8 points. The leaves are large for the size of the plant, 2 to 4 inches long, short-stalked, oblong in outline, sometimes only coarsely and irregularly toothed, sometimes with 3 to 5 deep lobes on each side. The flowers are in racemes, mostly from the axils of the upper leaves. There are from 3 to 10 flowers on each raceme, on rather short pedicels. They are an inch or less in diameter when expanded, having a 5-parted calyx and a 5-lobed bluish or whitish, spreading corolla. The flowers are succeeded by round berries, half to three-fourths of an inch in diameter, when mature of a yellowish color, and filled with pulp and numerous small seeds. The pedicels of the berries are reflexed, and the berries remain upon the plant into the winter. Common in the Southern and Western States, and becoming too frequent in the North. Darlington says:

This is an exceedingly pernicious weed, and so tenacious of life that it is almost impossible to get rid of it when once fully introduced. It grows in patches so thickly as to deter stock from feeding among it and even to monopolize the soil, while its roots gradually extend around and to a great depth.

It seems to prefer sandy soil, at least in the North, where it is sometimes called sand-brier. As it is perennial, and spreads by the root, only the most thorough treatment will eradicate it.

Plate XII, Fig. 1, a branch; Fig. 2, a raceme of mature berries.

Echium vulgare (blue-weed, blue-thistle, bugloss).

A biennial plant, of the order *Borraginaceæ*.

The stem is from 2 to 3 feet high, rough, hairy, and leafy. The leaves vary from lanceolate to linear, the lower ones 5 to 8 inches long, becoming shorter above, the uppermost bractlike and shorter than the flowering racemes. Like the stem, they are roughened with stiff whitish hairs, which have a stinging quality. The upper part of the stem, sometimes for more than half its length, bears numerous short, axillary spikes or racemes of flowers. These racemes are 1 to 2 inches long, and are coiled backward in bud, but straighten out as they expand. The flowers are rather crowded, and consist of a 5-lobed or cleft calyx, and a somewhat bell-shaped corolla about an inch long, which is purplish at first but changing to a light blue. When in full flower the plant has a handsome appearance. The nutlets, of which there are about 4 in each flower, are small, roundish, and rough, with a peculiar appearance, which has been likened to a viper's head. This plant is a native of Europe and Asia, but has become extensively naturalized along roadsides, in waste grounds and fields, principally in the Middle Atlantic States. (Plate XIII.)

Rumex acetosella, (sheep sorrel, field sorrel).

This small plant belongs to the order *Polygonaceæ*, or the family which contains the wild buckwheats and the docks. It multiplies rapidly by underground runners or roots. The stems are seldom more than 15 or 16 inches high, and are slender, erect, somewhat angular, and furrowed. The leaves are rather distant on the stem; the root and lower stem-leaves are on long and slender petioles, the upper ones becoming short-stalked or sessile. They have the peculiar form which is called *hastate*, that is, arrow-shaped, with the lobes spreading outward, or at right angles to the main part. Sometimes in the upper leaves the lobes are wanting.

The flowers are in racemes, at small distances apart, and in whorls of 3 to 6, nodding on the very short pedicels. The plant is of the kind called *dioecious*; that is, all the flowers of one plant are of one sex, either male or female. The flowers are very small, and in the male plants consist of the calyx of 6 sepals, 3 inner and 3 outer ones, and 6 stamens. In the female plants (and these are said to be larger than the male plants) the calyx is the same, but in place of the stamens, the small ovary, with its feathery stigmas, is seen, the ovary finally enlarging to form the 3-angled fruit. This sorrel is a native of Europe, but has become extensively naturalized in our country. It is often stated that the presence of sorrel is an indication of an unusual amount of acid in the soil, and that an application of lime or other alkali eradicates the sorrel by correcting the acidity. Such is not the case. Sorrel is generally most abundant on poor, light land, where little else will grow. An application of lime or other fertilizer enables other plants to grow and crowd out the sorrel.

Plate XIV, Fig. 1, a male flower magnified; Fig. 2, a female flower magnified.

Lychnis Githago (corn-cockle, or cockle).

A rather showy annual plant, belonging to the same family as the pink and sweet-william. It is a native of Europe, from whence it has been introduced with grain, and is now too commonly found in fields of wheat and rye.

The plant is from 2 to 4 feet high, sparingly branched above. The leaves are narrowly lanceolate, 3 to 5 inches long, less than half an inch wide, gradually tapering to a point, entire, thick, and, like the branches and calyx, covered with fine soft hairs. They are in single pairs at the base of each branch and opposite each other. The branches are slender, naked, and terminated with single flowers, which are 2 to 2½ inches long when expanded.

The calyx is 10-ribbed, and divided into 5 linear lobes, similar to the leaves, and longer than the corolla, which consists of 5 obcordate petals of a reddish-purple color, and about 1½ inches long. There are 10 stamens and 5 styles. The ovary develops into a roundish-oblong pod, filled with numerous dark-purple seeds, which under a lens are beautifully ribbed and roughened.

In regard to the comparative injury to wheat by cockle and chess a grain-dealer of Michigan writes :

In this State there is much more chess in wheat than cockle, but it is screened out easily, whereas cockle is very difficult to screen out, as it is as heavy and has nearly as large a berry as wheat. The chess is of no value, while the presence of cockle makes the flour of low grade.

A grain-dealer at Duluth, Minn., writes, December 30, 1886, concerning cockle :

Its effect on the grade of wheat as inspected here is serious. We had one car, which contained No. 1 hard wheat (our highest grade here), reduced to rejected (which is next to the lowest grade) solely on account of cockle. That would make a reduction in price of at least 15 cents per bushel.

A Minneapolis (Minn.) miller writes :

Cockle runs from 1 to 5 pounds to the bushel, 5 pounds being an extreme percentage. It is absolutely impossible to clean all the cockle out of the wheat, as it is so near the weight of the berry. Chess is found in winter-wheat sections, and can be all cleaned out of the wheat, as it is light, and can be handled to much better advantage than the cockle.

Sow a portion, at least, of the crop with perfectly clean seed on land where no grain grew the year before. Use this for the next year's seeding. In a few years the crop will be free from cockle. If, when clean seed is obtained, it is offered to surrounding growers, the area free from this weed may be extended, so as to lessen the liability of its being again introduced.

Plate XV, Fig. 2, a section through the ovary; Fig. 3, a seed magnified.

Chenopodium album (pig-weed, lamb's quarters).

This very common weed is of variable size, sometimes in good soil growing 5 or 6 feet high, in other circumstances reaching only 1 or 2 feet. The stem is rather stout and angular, and much branched. The leaves are on rather long and slender petioles, and vary from 1 to 3 inches in length, of an oblong or ovate form, the larger ones coarsely and irregularly toothed, the smaller ones narrow and mostly entire. The flowers are in small roundish clusters, at short distances apart, on slender spikes or racemes, which terminate the branches. The flower clusters are covered with a whitish mealy powder, and in many cases this mealiness extends also to the leaves. The individual flowers are very small, consisting of a five-cleft calyx, 5 stamens, and an ovary with 2 styles. The flower is destitute of a corolla. The mature ovary or seed is round in outline, but much flattened and lens-shaped, smooth, shining, and black, inclosed in a thin green

pericarp or cover. These parts require to be magnified to be distinctly seen.

This plant, as well as a number of others of the same family, is a native of Europe, but is extensively naturalized, and is found in waste places and cultivated ground. The young plants are sometimes used as a pot-herb.

The variety *viride*, by some considered a distinct species, has also been introduced, and is becoming in some localities even more abundant than the other. It is of a deeper green, has narrower leaves, and blooms earlier. (Plate XVI.)

Ranunculus acris (buttercup, tall crowfoot).

A perennial herb of the order *Ranunculaceæ*, a native of Europe, but extensively naturalized in New England and New York in pastures and meadows. The roots are fibrous, the stem is about 2 feet high, and branching near the summit. The leaves are mostly from the base, and on long stems, which are generally clothed with soft hairs. These leaves are roundish in outline, but divided into about three or five principal segments, and each segment is again parted into about three divisions, which are again cut into coarse teeth or lobes. The stem has but few leaves, and those more deeply gashed, with the uppermost reduced to a few linear segments. The flowers are at the ends of the long naked branches, either singly or 2 or 3 near together. They are about three-fourths of an inch in diameter and of a bright yellow color. The calyx consists of 5 green sepals, which are shorter than the petals and spread out horizontally. The outer organs soon fall off, and the ovaries mature into a roundish head of small, hard, flattened, and pointed carpels.

It is not uncommon in the New England States and in New York to see large fields of pasture-land completely taken possession of by this buttercup or crow-foot. On account of the acrid juice which it contains it is always rejected by cattle in the field, but as the acidity is dissipated by drying, the leaves are eaten when present in hay, but the long coarse stems are so much waste matter. (Plate XVII.)

Ranunculus bulbosus (bulbous-rooted buttercup).

A small species of buttercup, with a roundish bulbous root, also introduced from Europe and naturalized in some places, particularly in Pennsylvania and Virginia, to such an extent as to be quite a pest in meadows and pastures. The segments of the leaves are about three, not so close together as in the *R. acris*, and generally with fewer lobes. The flowers are of about the same size and color as the preceding, but the sepals or parts of the calyx are reflexed. (Plate XVIII.)

Barbarea vulgaris and *Barbarea præcox* (winter-cress, scurvy-grass).

A biennial plant of the natural order *Cruciferae*, related to the mustard, turnip, cress, and cabbage. It grows to the height of about 2 feet. The stem is disposed to branch at the upper part. It produces numerous yellow flowers in rather close, short racemes, which as they grow older are elongated and covered with somewhat four-sided, narrow pods, about an inch in length. There are two species, differing principally in the leaves, which in *B. vulgaris* are shorter, with a large roundish extremity and sometimes a few short lobes be-

low; in *B. præcox* the leaves are longer and pinnatifid, with irregular lobes, decreasing in size from the apex toward the base.

In the vicinity of New York, Philadelphia, Baltimore, &c., this plant is considerably cultivated as an early salad, and has escaped from cultivation to such an extent as to become very troublesome in cultivated fields. As found in these places it is probably introduced from Europe, but in the neighborhood of the great lakes, in Canada, and northward it is thought to be a native plant. (Plate XIX.)

Chelidonium majus (celandine).

A plant of the poppy family (*Papaveraceæ*). It is herbaceous and perennial, growing $1\frac{1}{2}$ to 2 feet high, with a brittle, watery stem, which when broken emits a yellowish, disagreeable-smelling juice, which is bitter and acrid. The stem is somewhat branching, with large pinnatifid leaves. Those from the root are on long stalks, those on the stem are short-stalked or the upper ones sessile. They are usually 3 or 4 inches long and nearly as broad, divided into about five principal segments, which are again subdivided into a few lobes and coarse teeth. The flowers are in small clusters of 3 to 8 at the extremity of the branches, each one on a short stalk or pedicel. They are less than an inch in diameter when expanded, and of a bright yellow color. The calyx consists of 2 greenish sepals, which fall off when the flower expands. The corolla is composed of 4 oblong petals, within which are an indefinite number (usually from 16 to 20) of stamens, and centrally the ovary, which enlarges into a slender, smooth, two-valved, many-seeded pod, about an inch in length.

This plant is rather common about dwellings in the Eastern States, and, although classed as a weed, it is one which interferes principally with garden culture. Like many other common weeds, it is introduced from Europe. (Plate XX.)

Capsella bursa-pastoris (shepherd's-purse).

One of the commonest garden and roadside weeds. It is an upright annual plant of variable size, sometimes fruiting when 2 or 3 inches high, and sometimes attaining a height of 18 inches or more. The leaves are mostly near the lower part of the plant, the upper ones becoming small, narrow, and somewhat arrow-shaped, while the lower ones are sometimes 5 or 6 inches long, pinnatifid, and toothed like those of the dandelion. The flowers are very small, and at first somewhat crowded near the end of the branches, but in age becoming much separated, and forming a long, leafless raceme. The flowers have the same general structure as those of pepper-grass and radish, and the plant belongs to the same natural order, *Cruciferae*. The pods are on slender pedicels, which are half to three-fourths of an inch long. They are about one-fourth of an inch long, of a peculiar form, flat, broad at the top, and notched at the apex, then narrowed to the base, presenting somewhat the appearance of a purse, from which appearance comes the common name of shepherd's-purse. The pods consist of two lobes or pouches, fixed on opposite sides of a flat thin partition, to which the seeds are attached. Although this weed is very common and abundant, it can generally be easily destroyed by careful culture. (Plate XXI.)

GEORGE VASEY,
Botanist.

Hon. NORMAN J. COLMAN,
Commissioner.





R. Coning sc.

TRIFOLIUM FUCATUM.



R. Ewing. del.

TRIFOLIUM MEGACEPHALUM.



R. Cowling

W. H. CHAMBERLAIN del.

TRIFOLIUM INVOLUCRATUM.



TRIFOLIUM STOLONIFERUM.



TRIFOLIUM CAROLINIANUM.



CNICUS ARVENSIS (CANADA THISTLE).



ARCTIUM LAPPA (BURDOCK).



XANTHIUM CANADENSE (CLOT-BUR).



R Cowing del.

AMBROSIA ARTEMISIEFOLIA (ROMAN WORMWOOD).



R. Cowing del.

CHRYSANTHEMUM LEUCANTHEMUM (WHITE DAISY).

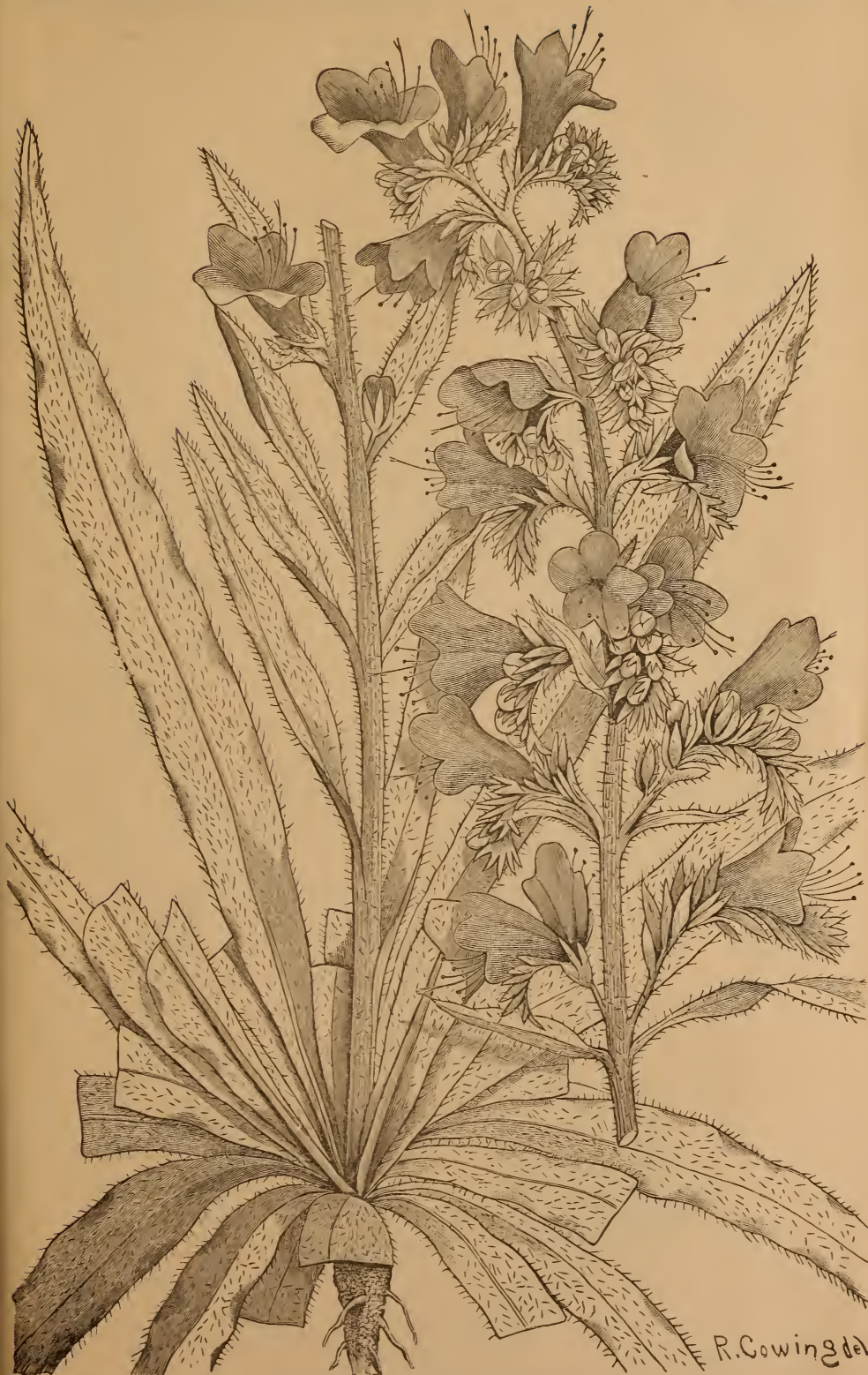


ABUTILON AVICENNÆ (VELVET-LEAF).



R. Cowing del

SOLANUM CAROLINENSE (HORSE-NETTLE).



R. Cowing del

ECHINOPS VULGARIS (BLUE THISTLE).



RUMEX ACETOSELLA (RED SORREL).



LYCHNIS GITHAGO (CORN COCKLE).



CHENOPodium ALBUM (PIG-WEED).



RANUNCULUS ACRIS (TALL CROWFOOT).

Covring. del.



RANUNCULUS BULBOSUS (BUTTERCUP).



BARBAREA VULGARIS (WINTER CRESS).



CHELIDONIUM MAJUS (CELANDINE).



CAPSILLA BURA-PASTORIS (SHEPHERD'S PURSE).

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